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(54) **ALARME POUR SEPARATION DE ROUE**

(54) **WHEEL DISCONNECT ALARM**

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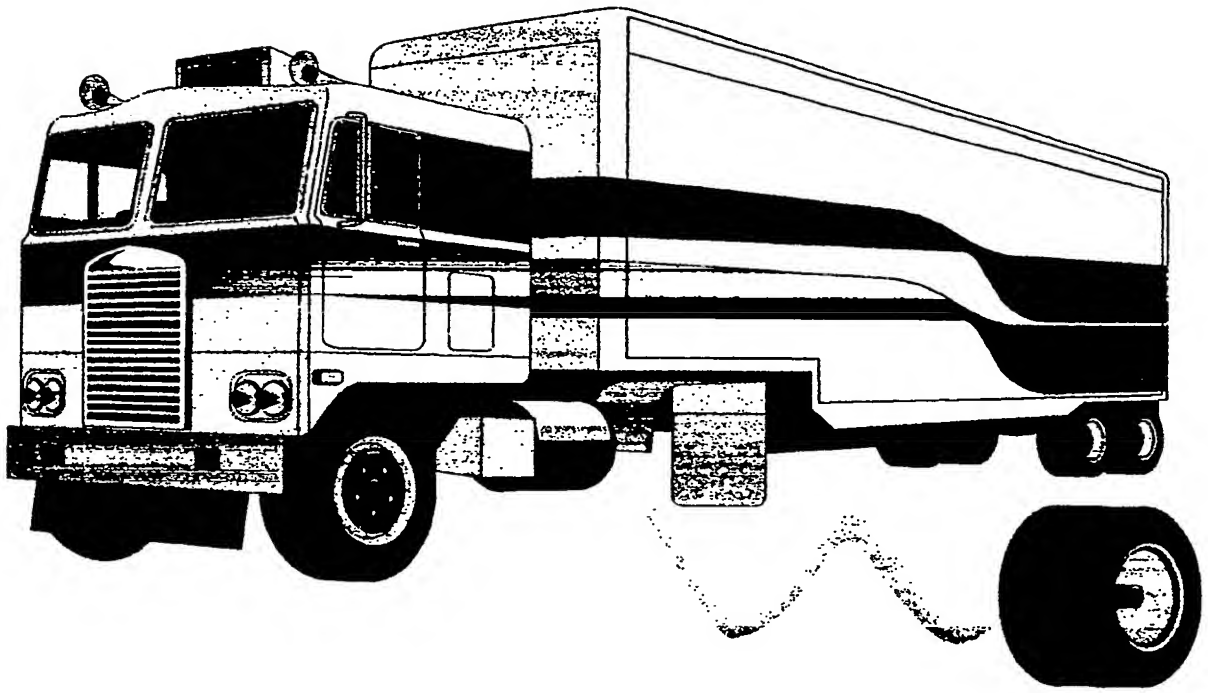

DISCONNECT ALARM

BY
FINAL DRAW

WHEEL DISCONNECT ALARM

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WHEEL DISCONNECT ALARM

PURPOSE –

The purpose of this circuit is to WARN the driver of the vehicle using alarm devices that will detect in advance, a possible **"Wheel Disconnection"**. This wheel disconnect alarm will detect either of the following conditions:

1. A pending 'wheel disconnection' caused by **bearing failure** (Inner or Outer) occurring inside the axle of the vehicle (Sketch D & D1).

Major causes of bearing failure are bearing fatigue (age/wear), overloads, and loss of lubricant. Oil seals or lubricant housings break because the dual wheels are often dragged around corners (tight corner slippage), maneuvered over street curbs and large roadway holes, etc. This housing breakage allows the lubricant to escape causing the bearing to overheat, then fail. In these instances, friction caused from 'bearing failure' creates a large amount of heat on the outside housing of the axle. Once a certain temperature is reached, the entire dual wheel becomes dislodged from the axle. Heat sensors are attached to a bracelet and then the bracelet is fastened to the axle housing (Inner & Outer) to monitor heat levels, which indicate 'wheel disconnect' conditions.

2. A pending 'wheel disconnection' caused from a **loose wheel bolt** allowing a wheel to disconnect from the wheel stud and the axle (Sketch C).

A major cause for a loose wheel bolt is when wheels are subjected to extreme cornering, to extreme bumps or poor maintenance. A micro switch or plunger switch is attached to a wheel rim (Ref. Sketch C). This switch converts the mechanical relationship between a wheel bolt and a wheel stud into a normally open, electronic condition, while the bolt is securely fastened to the stud. Once the bolt becomes loose by one or two turns, contact pressure between the micro switch and the bolt collar is removed causing the switch to change from an open type switch contact to become a closed electronic switch contact (Ref. Sketch C2). The closed electronic switch contact extends an operating voltage (zero ground) to a transceiver (Sketch C2). The transceiver then encodes a tone (submits a digital tone) to a receiver located in the monitor alarm unit located near the driver (Sketch B). This decoder is used to announce the alarm to alert the driver of the loose wheel bolt and pending 'wheel disconnect'.

MAJOR APPARATUS –

1. 'Heat Sensor Switch' - (Sketch A, Sketch D & D1)

A Heat Sensor Switch is fastened to a bracelet; then each axle housing (Inner & Outer) is equipped with this bracelet (Sketch D1). The heat sensor switch provides advance detection by monitoring heat that is created when a bearing fails. The temperature of the heat sensor (approximately 200 - 400 C) is somewhat lower than the actual heat temperature that is responsible for a wheel to become disconnected. This allows the heat sensor to operate in advance of the actual wheel disconnection and to warn the driver in advance of a pending 'wheel disconnect'.

2. ' Transceiver' - (Sketch B & Sketch E); & 'Micro Switch' - (Sketch C & D)

A Transceiver is connected to a Micro Switch (or the Plunger Switch) and the outer wheel bearing heat sensor switch. The transceiver, bolt/collar micro switch and heat sensor switch are fastened to the wheel. (Reference Sketch C1, C2 & C3).

3. 'Monitor Unit' - (Sketch A & Sketch B)

A Monitor Unit is located inside the vehicle to monitor the activity of both devices listed for 1 & 2 above. An active change in either device causes an alarm to alert the driver. The alarm includes both an audible (piezo buzzer Z) and flashing visual LED (Light Emitting Diode) . This unit contains the following components: (IC = Integrated Circuit)

IC1	FL Flasher providing the alarm flashing ground zero volt (-V); type 555.
IC2 - IC6	RS Remote Sensing Switches; type 4066
Z	Piezo Buzzer for audible alert in an alarm.
LED	Light Emitting Diode
D	Decoder (Receiver)
TR2	Transistor type 4401
RCL1	Resistor 330 ohms; 1/4 watt
RF, RE, RS	Resistor 220 ohms; 1/4 watt
D1	Diode type IN4001

OPERATION:

ALARM occurs as follows:

A: Circuit Continuity- (Arrangement for Heat Sensor / INNER Bearing Failure Only)

In a state of readiness, each INNER heat sensor switch (HS) provides a continuous ground (Zero Volts) via normally closed switch contacts, to cause an assigned axle (LED) Light Emitting Diode to illuminate in a nonactive, **'No Alarm'** state. The LEDs illuminate continuously to indicate circuit continuity, monitoring 'physical wire connections' only in a fail-safe mode. If by some means a wire breaks or the heat sensitive switch becomes unconnected, the continuous ground provided by the normally closed heat sensor contact, continuous (HS) ground is removed; ground short to the RS switch (IC1 - IC5, R5/R4 Multiple) allows the RS switch to operate, to provide a zero volt (-V) ground to allow the operation of the IC1 FL flasher. The FL flasher then provides a 'flashing ground' through the operated RS switch contacts to replace the continuous ground previously provided by the unconnected heat sensor switch (HS). The flashing ground (from FL/IC1) causes the unconnected HS, associated LED to flash off, then on, then off, etc. indicating an **'Alarm'** state. The same zero ground (-V) provided to operate the IC1 (from the alarmed RS switch contact) is also extended to operate the Piezo Buzzer (audible alert). Resistors R1 and R2 determine the flash time (on/off) intervals.

B1: Bearing Failure ALARM
Heat Sensor Switches – (Sketch A & Sketch D2) - With Circuit Continuity

The contact within the heat switch is a **normally closed** switch contact. Once the heat sensor switch detects excessive heat (created in the axle housing from bearing failure) the heat sensor switch contact HS open to remove the continuous ground (Sketch A & Sketch D2). With the continuous ground (-V) removed (shunting the assigned remote switch RS), the assigned circuit connected RS switch, operates the flasher FL/IC1 (Sketch A, IC2 through IC5). The IC1 flasher FL then provides a flashing ground (-V) via the operated RS switch contacts to replace the continuous ground (-V) previously provided by the related heat sensor switch (HS). The flashing ground from IC1 causes the LED to flash in an Alarm-State. The same zero ground (-V) provided to operate the IC1 (Integrated Circuit #1) from the alarmed Remote Switch RS contact, is also extended to operate the Piezo Buzzer 'Z' (audible alert). Resistors R1 and R2 determine the flash time interval to operate the LEDs in the Alarm-State.

B2: Bearing Failure ALARM
Heat Sensor Switches – (Sketch A1 & Sketch D3) - Without Circuit Continuity
– For both Inner and Outer Bearing Failures

Heat sensitive switches (HS) are mounted on a bracelet then attached to the axle of the vehicle. The contact within the heat switch is a **normally open** switch contact. Once the heat sensor switch detects excessive heat (created in the axle housing from bearing failure) the heat sensor switch contact HS close in an alarm condition (Sketch A1 & Sketch D3). This closed alarm condition extends an operating zero ground (-V) to operate the connected transceiver (Sketch E). The transceiver encodes the alarm to a separate, assigned decoder in the monitor unit the same manner as described for the loose bolt alarm.

C: Loose Wheel Bolt ALARM
Micro Switch / Transceiver - Encoder / Receiver - Decoder

- Micro Switch / Plunger Switch -- Sketch C, Sketch C1 & Sketch C2

A mechanical micro switch is attached to a wheel rim to electro-mechanically convert a mechanical pressure contact between a bolt fastened with a collar (Ref. Sketch C) and an associated wheel micro switch into 'circuit logic' as follows:
When a wheel bolt is tightened on the stud of the wheel, 'contact pressure' is applied between the mechanical switch (plunger portion of the micro switch mounted with the transceiver and on the wheel rim) and the wheel stud (Sketch C1). This tightened mechanical 'contact pressure' between the collar and arm of the micro switch causes the switch to **OPERATE** its' contact in an 'open' condition (Sketch C). This 'open' condition disconnects (removes) an operating voltage, zero ground (-V) from the connected transceiver. Once a wheel bolt loosens or unwinds one or two turns, contact pressure applied between the bolt mounted collar and the mechanical switch, plunger portion of the micro switch mounted on the wheel rim, is removed causing the mechanical switch contacts to **RELEASE** in a **'closed'** electrical condition (Sketch C1). This closed condition extends an operating voltage zero ground (-V) to cause the electrically connected transceiver to activate.

- Transceiver Encoder -- Sketch B & Sketch E

The Transceiver, when made active, is used to encode the loose wheel bolt and/or wheel bearing failure by transmitting a digital tone (frequency) to the vehicle-monitoring receiver where it is decoded as a 'wheel alarm'. Switch closure, as previously described, extends zero ground (-V) to activate a Transceiver much the same as a regular, everyday household 'garage door' opener (located in some vehicles) that transmits a special tone to a 'garage door' receiver .
A Transceiver is used with Normally Open type heat sensor (HS) switches to eliminate costly wiring directly to individual assigned axle LEDs (located within the monitor unit). The continuity alarm (having the LED illuminate continuously) is eliminated when the HS switch logic changes from normally closed to this normally open type . Switch closure then occurs when the dangerous heat is detected during the Alarm-State. This closed condition extends zero ground (-V) to operate/activate the electrically connected transceiver.

- Receiver - Decoder -- Sketch B

A Decoder 'D' (located inside the monitor unit) recognizes the transceiver tone, decodes the tone and extends an operating voltage (zero ground) to the TR transistor (Sketch B & Sketch C2) causing the TR transistor to release and RE transistor to operate with the same flashing alarm procedure (LED and audio buzzer) as describes for the heat sensor switch, HS operation. A Latching zero ground (-V) is provided via IC6, through diode D2 to latch this **'Loose Bolt'** alarm circuit in the alarm condition. This latching function is provided to replace any momentary pulses that have incurred from 'contact bouncing'. The micro switch connected to the wheel bolt may experience momentary open and closures (contact bounce) during the first turn of a loose wheel bolt alarm. Other occurrences such as a rock impact on the wheel might cause a similar contact bounce. A push button (LR) switch when operated will disable the momentary type alarm. If the alarm immediately reoccurs, the alarm is genuine.

NOTES

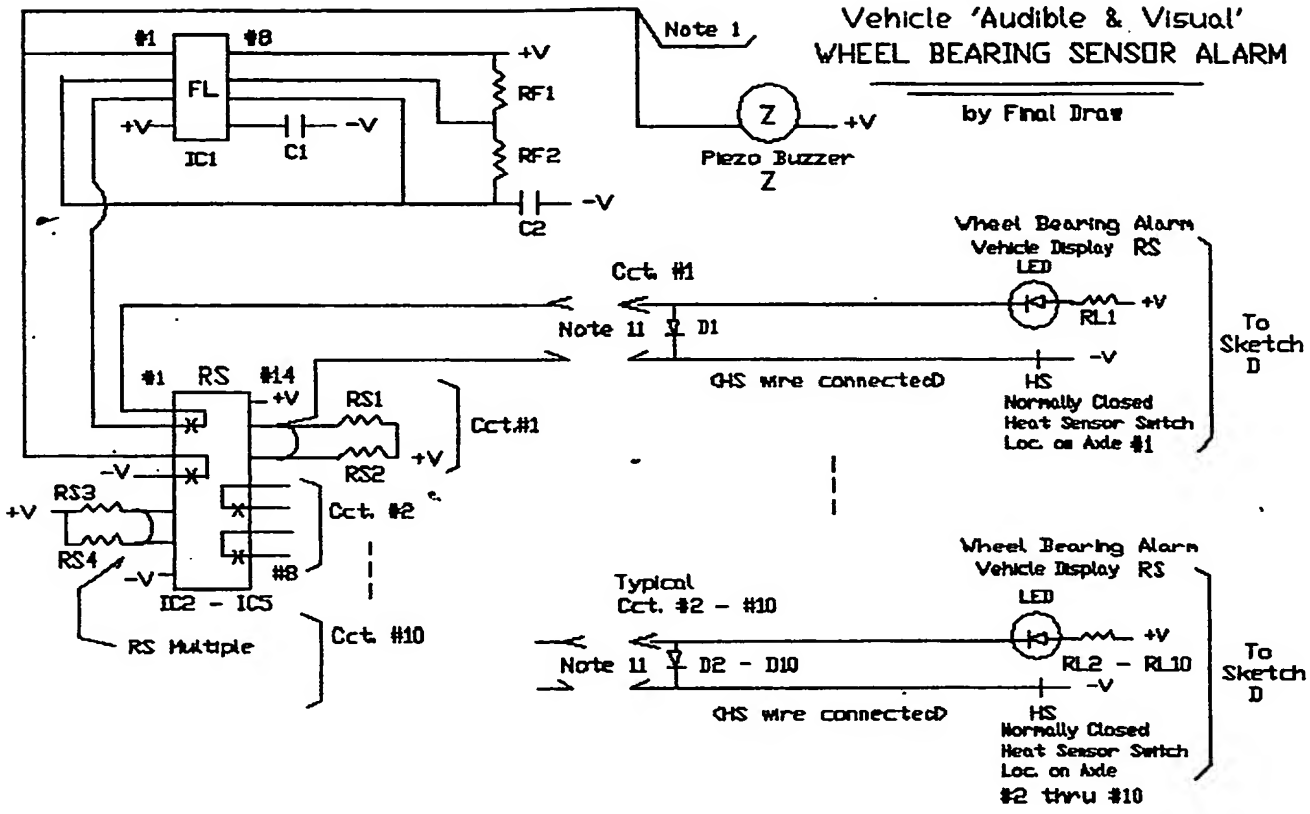
1. Multipled thru to circuits 1- 10 and 'LWNC' (Loose Wheel Nut Circuit).
2. Capicator C1 = .01uf.
3. Capicator C2 = 10uf.
4. Reisistors RF! & RF2 = 22K ohms.
5. Resistors RS1 thru RS4 (all desiginated RS count) etc, RE4 thru RE5 = 221K.
6. Resisitors RL1 thru RL10 & RCL1 are .33k ohms.
7. Diodes are type IN4001 or equivalent.
8. Transistor T2 = type 4401.
9. Integrated Circuit IC1 = type 555.
10. Integrated Circuits IC2 thru IC6 = type 4406.
11. Connect to each 'RS' (Remote Switch) Mult. of each Circuit IC2 thru to IC5.
12. Latch Release 'LR' is a normally closed single pole contact switch; pluse type.

Sketch A

Vehicle 'Audible & Visual'

WHEEL BEARING SENSOR ALARM

by Final Draw

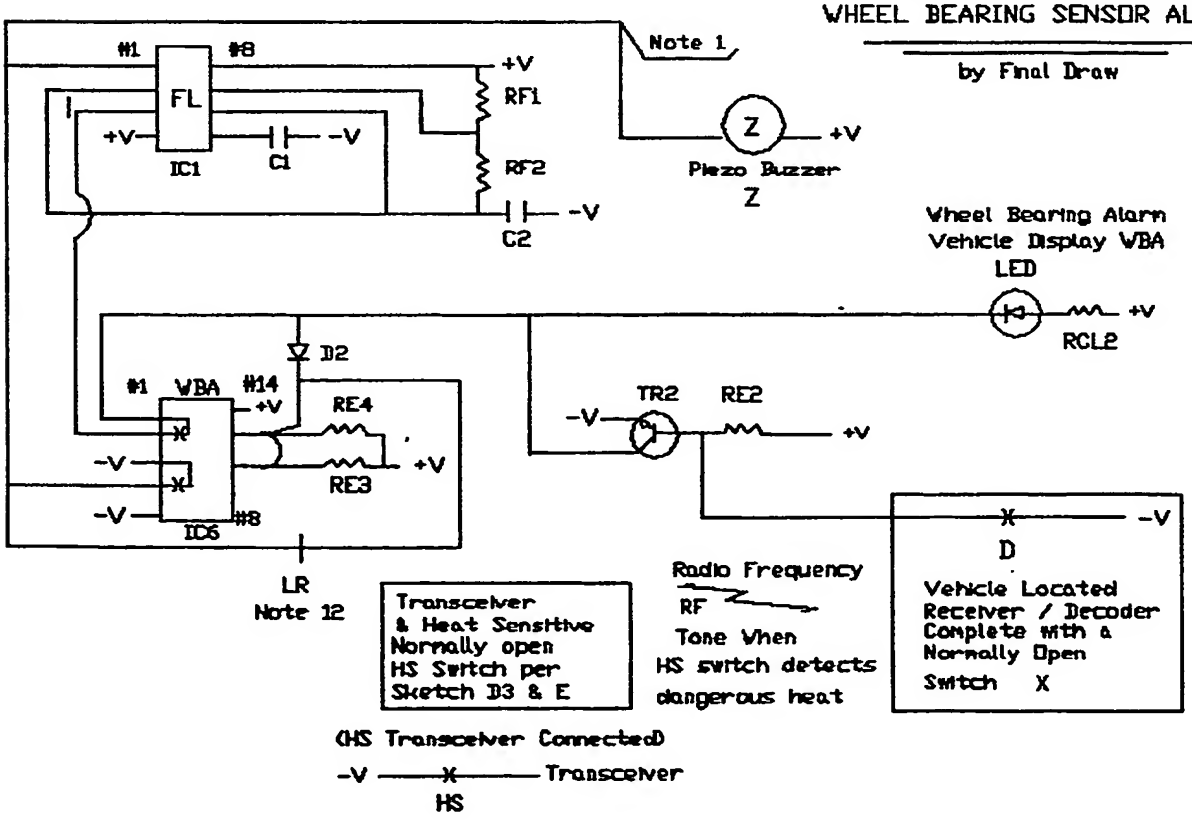


Sketch A1

Vehicle 'Audible & Visual'

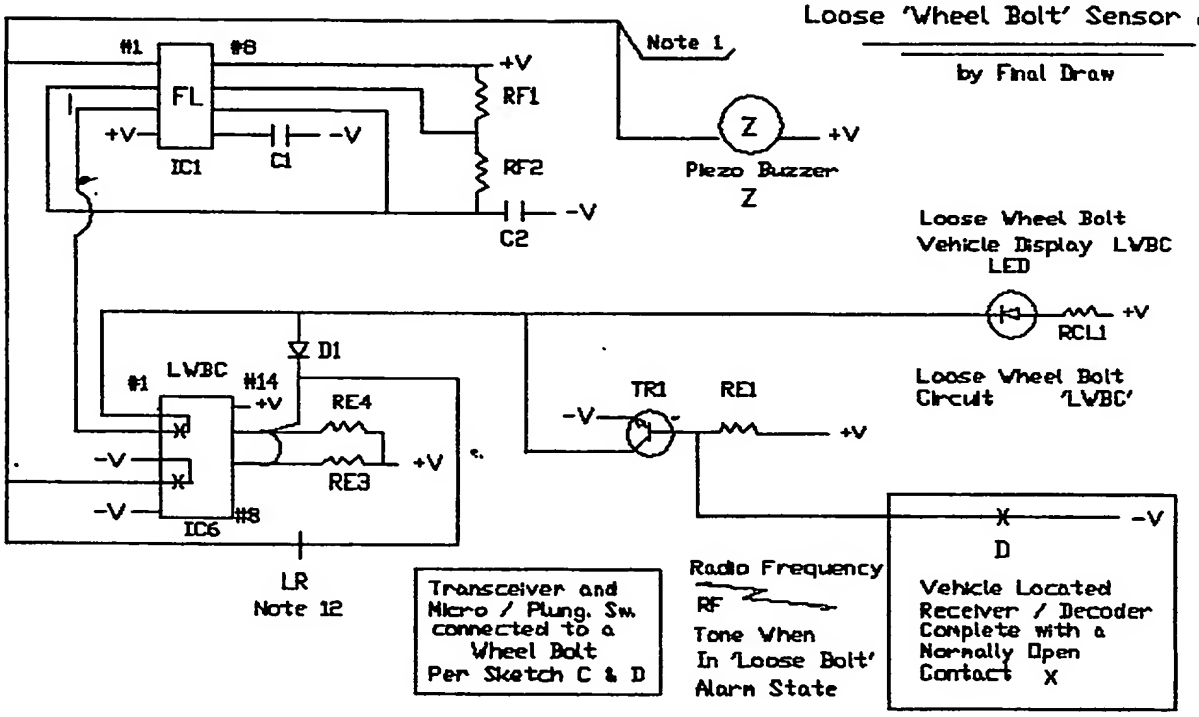
WHEEL BEARING SENSOR ALARM

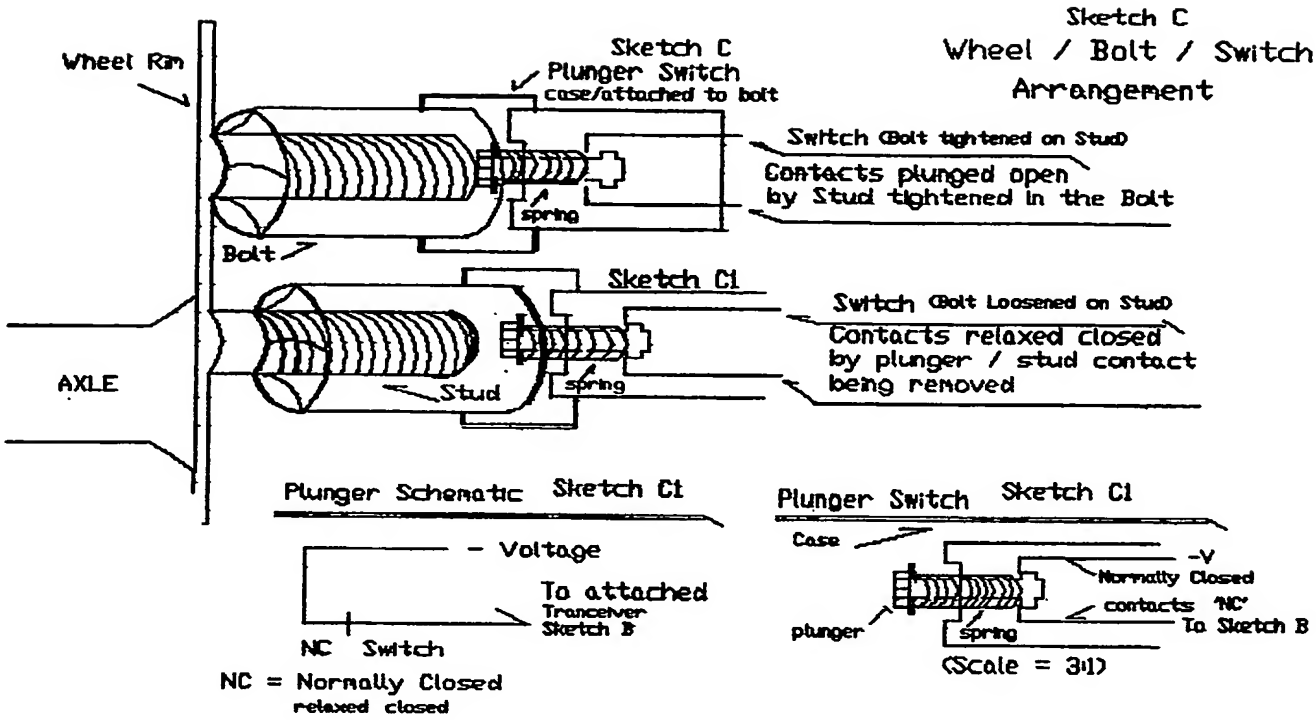
by Final Draw

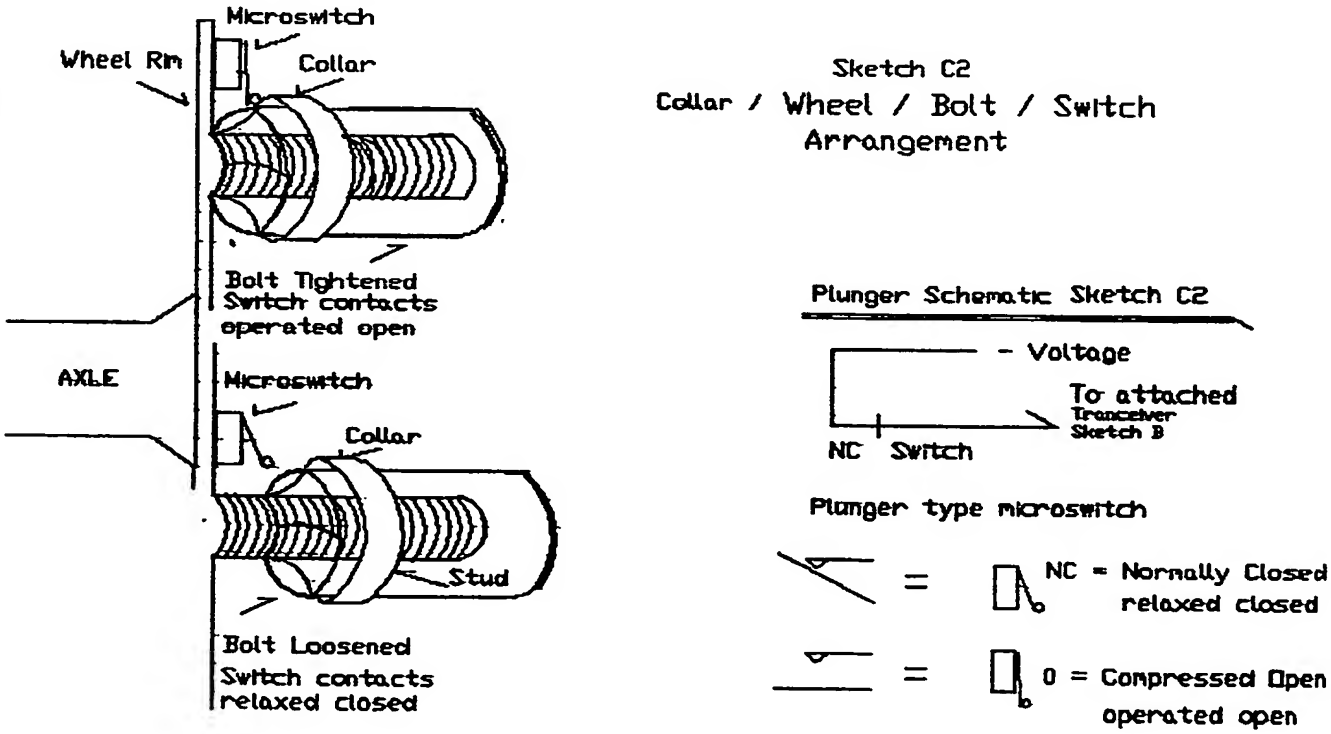


Sketch B
Vehicle 'Audible & Visual'
Loose 'Wheel Bolt' Sensor Alarm

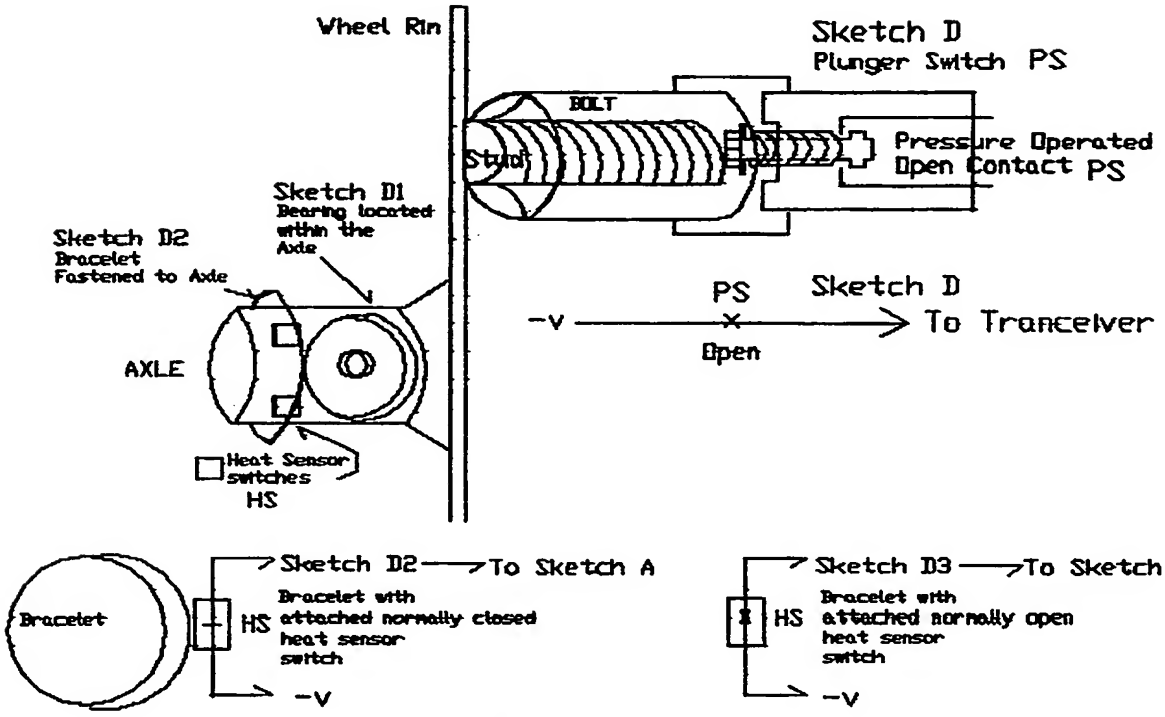
by Final Draw

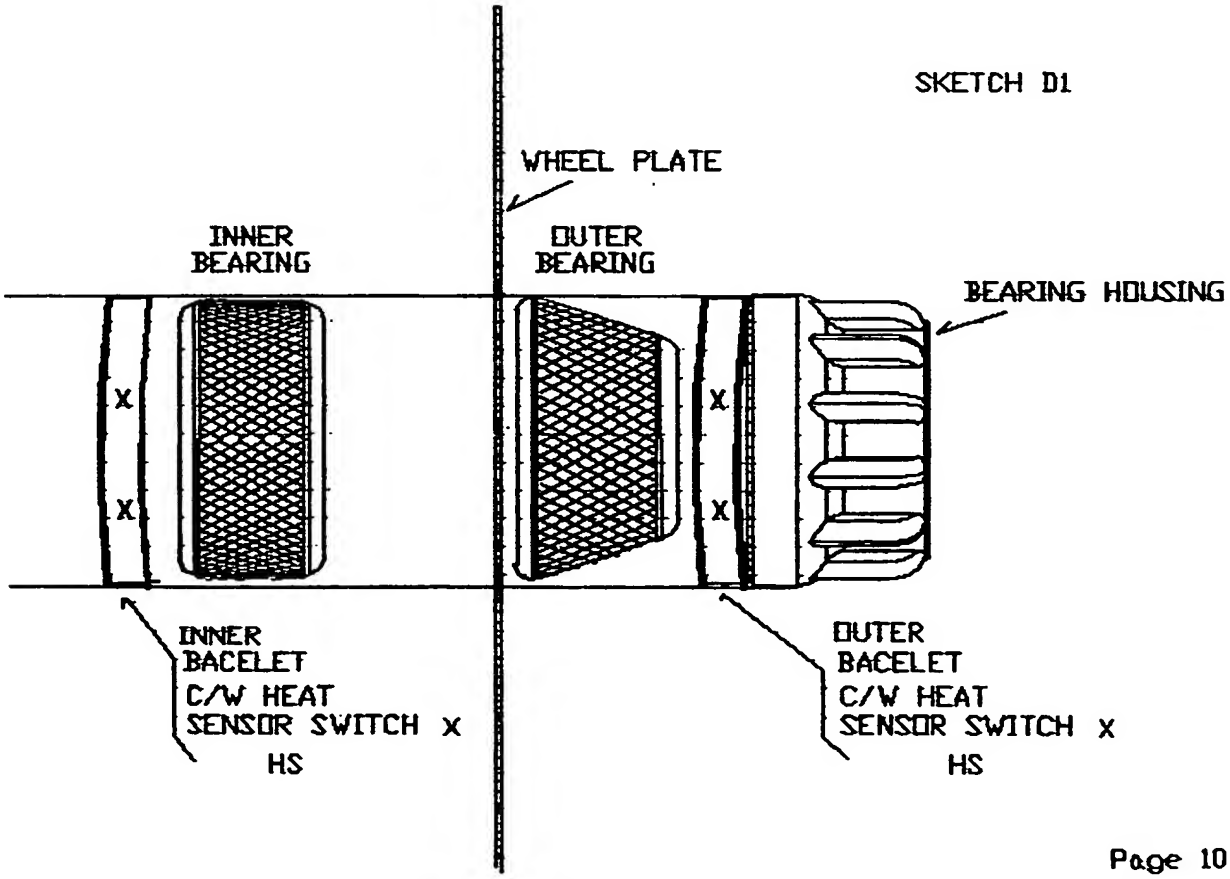



Sketch C
Wheel / Bolt / Switch
Arrangement
Wheel Rim
Sketch C
Plunger Switch
case/attached to bolt
Switch (Bolt tightened on Stud)
Contacts plunged open
by Stud tightened in the Bolt
spring
Bolt
Sketch C1
Switch (Bolt Loosened on Stud)
Contacts relaxed closed
by plunger / stud contact
being removed
AXLE
Stud
spring
Plunger Schematic Sketch C1
- Voltage
To attached
Tranceiver
Sketch B
NC Switch
NC = Normally Closed
relaxed closed
Plunger Switch Sketch C1
Case
-V
Normally Closed
contacts 'NC'
To Sketch B
plunger
spring
(Scale = 3:1)

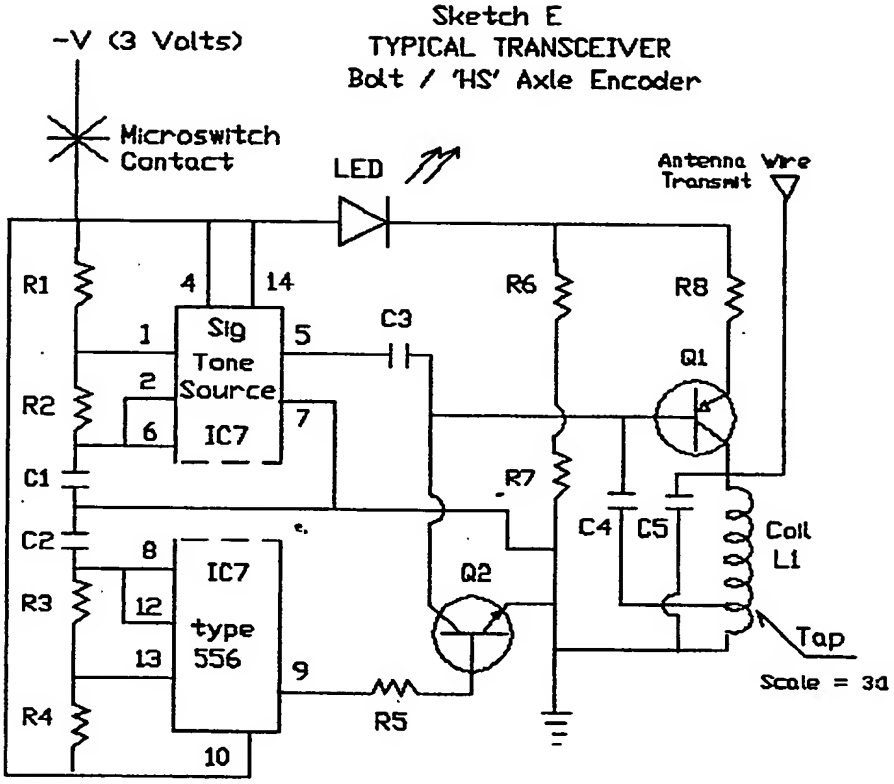

Microswitch
Wheel Rim
Collar
Sketch C2
Collar / Wheel / Bolt / Switch
Arrangement
Bolt Tightened
Switch contacts
operated open
AXLE
Microswitch
Collar
Plunger Schematic Sketch C2
- Voltage
To attached
Tranceiver
Sketch B
NC Switch
Plunger type microswitch
Stud
Bolt Loosened
Switch contacts
relaxed closed
NC = Normally Closed
relaxed closed
O = Compressed Open
operated open

Sketch D
Wheel / Bolt / Switch / Bracelet
Arrangement





Sketch E
TYPICAL TRANSCEIVER
Bolt / 'HS' Axle Encoder



Sketch E
TYPICAL PLACEMENT